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desensitized. 7. It should not be forgotten that a preliminary injection of atropin will greatly ameliorate and even prevent anaphylactic reactions.

Sensitization may be tested for after the manner of a Von Pirquet reaction by rubbing a little of the serum to be injected into a slight skin abrasion, when local edema and papule formation will occur within a short space of time if the patient is hypersensitive, or it may be tested for by the hypodermic injection of a small amount, a positive reaction being evidenced by the same phenomena.

Desensitization is accomplished by the subcutaneous, intravenous, or intraspinal injection—according to the method by which the serum is to be used—of a small amount of the diluted serum, (0.1 to 1.0 cc. of a one to twenty dilution in normal saline solution), followed by the full dose after an interval of from two to three hours.

The treatment of anaphylaxis in its severer grades lies in the prevention of the occurrence. In the milder manifestations, the treatment is, in the main, symptomatic; namely, atropin and adrenalin hypodermatically for the respiratory symptoms, wet packs for the fever—avoiding coal-tar drugs and antipyretics—and local treatment for the urticaria and joint symptoms.

It is well to remember that while the symptoms of serum sickness, as usually seen, may come on with alarming rapidity and assume alarming proportions, as a rule they disappear within forty-eight to seventy-two hours and fatal results are, fortunately, infrequent, and that the possibility of serum sickness should never constitute a contraindication to the use of serum in those conditions in which serum alone offers a means of saving the patient.

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## MOSQUITOES

BY EDNA MEIER BURDICK, R.N.

*Cristobal, Canal Zone*

Mosquitoes are biting gnats, small insects having two wings, six legs, and a body divided into three parts, the head, the thorax, and the abdomen. On the head of the mosquito are two large eyes, and projecting from the part of the face in front of, between, and below the eyes, is the proboscis, or "stinger." At either side of this are the palpi, or feelers, one on each side, and to the outer side of the feelers, are the antennae, or plumes. All persons who are bitten by mosquitoes have had experience with the proboscis, which contains a number of small lancet-like knives.

Male mosquitoes, *of all kinds*, may be distinguished from the

females, by their larger, more feathery antennae, in marked contrast to the scanty, down-like, and short antennae of the female; this is an easily recognized indication of sex. As males rarely bite, they are unimportant from a health standpoint.

This description is of the adult mosquito, but mosquitoes, like butterflies, pass their existence in four stages. These stages are the egg, the larva, the pupa, and the adult.

The eggs of mosquitoes are very small. They vary in size, shape, pattern of shell, (some of which are really beautiful, when highly magnified), and in the method of grouping in which they are deposited. The ordinary *Culex* mosquitoes, for instance, deposit their eggs in masses, composed of eggs packed side by side, in a very neat, and regular manner, and these masses float on the water, as little rafts or boats. The *Anopheles* mosquito, on the contrary, deposits her eggs singly, and because of the small size of a single egg, it is very difficult to see and recognize it. In general she likes clear, fresh water, in which grass and algae are plentiful, as small mountain streams, or fresh water ponds and pools. The grass protects the larvae from fish. Wherever the small fish can gain access, mosquitoes cannot breed. If the water is deep enough, and clear of grass, so that fish have free access, the fish destroy all larvae, and the mosquitoes do not develop.

Other species breed in dirty and muddy water. The two species with which we are most concerned, as being disease-carrying, are *Anopheles* and *Stegomyia*.

Whether mosquito eggs are deposited singly, or in groups, they are always deposited on water, and as the female mosquito only lays eggs after she has eaten blood, and as she is then so heavy with the imbibed blood that her flight is slow and laborious, she usually goes to the nearest suitable water to deposit them. It is for this reason that most mosquito-infested places are found to be breeding their own mosquitoes. The eggs float for two or three days, after which they open, and the young larvae, or "wigglers," escape into the water. Here they live for a week or more. Though living in the water, they are air breathers; they obtain it by coming to the surface of the water, and protruding from it the small air tubes that project from near their tails. This method of breathing enables the application of the most valuable measure of mosquito destruction, oil on the water. If the water be covered with a thin film of oil, the breathing tube becomes obstructed with the oil, followed by suffocation. After the larvae have attained an age of a week or more, the time varying with the weather and other conditions, they change to pupae or tumblers. The pupal stage corresponds to that of the caterpillar's chrysalis, and

is one of change and of no food. Sealed in its hard pupal case, the larva changes to a mosquito, and in a few days emerges, dries, unfolds its wings, and flies away.

From first to last, from egg to insect, the process of development takes from seven to ten days in a tropical climate, but may take almost a month in some temperatures. As each female may lay eggs many times in a season, and many hundreds of eggs each time, and as the young female can produce eggs within a week or ten days after her emergence from the pupa-case, it follows that one pair of insects can give rise to several million of their kind, in the course of a summer. Some species of mosquitoes can live several months, if they have food and water.

The *Anopheles* is the genus of mosquitoes whose bite is the means by which humanity is infected with the malaria parasite. Not all *Anopheles* are capable of carrying malaria, and those that can do so, are often difficult to distinguish from those that cannot, so it is well to regard them all as carriers. The female mosquito, only, is a germ carrier. The male feeds almost exclusively on vegetable juices, while the female adult feeds on juices, as well as sucking blood of mammals, birds, reptiles, insects, and at times of fish. In feeding, the mosquito raises her hind legs, and presses the tip of her proboscis against the skin. A mosquito will fill herself in a minute or thereabouts.

One method of distinguishing the *Anopheles* mosquito is that the palpi are almost as long, in them, as the proboscis, while in other varieties they are much shorter. Second, the hind legs are very much longer than the fore legs, which gives the mosquito an appearance, when at rest, of standing on her head, or almost perpendicular to the surface on which she rests, while most other varieties hold their bodies more nearly parallel to such a surface. Third, the head and body are almost in a straight line, while others are more hump-backed. The larvae also differ much in size and shape. The larva of the *Anopheles* can be recognized by the way it comes to the surface to breathe, as the siphon, or breathing tube, is shorter than those of other mosquitoes. The larvae themselves float on, or are parallel with, the surface of the water when at rest, while most other larvae hang with their heads downward, and with their bodies forming almost a right angle to the surface of the water. They are long, and very slender; they dive, or seek shelter in grass at any sound or shadow on the water.

There are six or seven hundred species of mosquitoes, differing widely in habits of flight. The *Culex Solicitans* is very strong and bold in flight; it can fly twenty miles in one night, before a favoring

breeze. This is the common gray mosquito which breeds so abundantly in the salt water marshes of our Atlantic Coast. It is generally believed that all mosquitoes are blown by or travel with the wind, however, there are a few known instances, in which they did not fly with the wind, and also, in which they flew against the wind. The adult mosquito is destroyed by wind or sunlight, and it seeks shrubbery, grass, and foliage for protection. The *Anopheles* is not a mosquito of strong flight; two hundred yards is, in general, a good long flight for it, and unless it has bushes in which to rest, free from sun and wind, it does not go far. A flight of at least a mile and a quarter has been demonstrated for it; however, it is thought it will fly longer distances for a blood meal. Accordingly, all breeding places for at least a mile from settlements are destroyed, if possible.

No *Anopheles* occur in empty houses, thus it would seem possible that some species are attracted by scent. Strong lights are powerfully attractive to the female *Anopheles*, and interfere considerably with their bitings, unless they are very hungry. Thus, they disturb us less in the light. Their characteristic musical note is associated with the vibration of the proboscis.

It takes ten days from the time at which the female *Anopheles* bites the person sick with malaria, until she herself becomes able to transmit the disease. Malaria is caused by a small animal parasite, which lives in the blood of man, and feeds upon the red globules. Excretions of this parasite poison man and cause the fever. This parasite is transferred from the sick man to the well man by the mosquito's bite. These parasites are small moving bodies that live in the blood and its red cells. After attaining its full size, the cell divides into from eight to thirty smaller cells, which are set free in the blood, and attack other red cells, in which they go through the same growth and division. This freeing of young germs occurs with considerable regularity, and at intervals of 24, 48, or 72 hours, depending upon the type of parasite. Occasionally, there are so many generations of parasites in the blood, that the fever may be almost continuous, or the chills may come irregularly. The mosquito's salivary glands produce the irritating fluid, which the insect injects when it bites.

Next to the malaria mosquito, the yellow fever mosquito is the most numerous. It has been proven clearly that yellow fever is conveyed solely by the bites of one kind of mosquito, the female "*Stegomyia Fasciata*," now called "*Edes Colopus*." The stages of this mosquito are egg, larva, pupa, young new born, and the mosquito that has passed the period of extrinsic incubation, ready to convey

yellow fever. The eggs are dark, spindle-shaped, and vary considerably in shape and size. The bosses, with which the eggs are studded, are possibly connected with the ability which the eggs seem to possess of replacing moisture lost through desiccation. The *Stegomyia* prefers clear, clean water, as rain water, for her eggs.

The yellow fever mosquito is small and dark, with white stripes, bands or spots around joints of its legs, and a white lyre-shaped figure on the back of its thorax, which gives it a grayish appearance. In India it is called the tiger mosquito, on account of its stripes. The *Culex Solicitans* (found in the North) and the *Stegomyia*, look much alike to the naked eye. It is silent and rapid in flight, does not ordinarily sing, or buzz, is a persistent biter, takes flight quickly, and is very hard to catch while biting. It may bite by day or night. It is more of a house lover than any other mosquito, and when a house is infected with it, one can certainly say that the insects are breeding in or near the house.

The enemies to the adult mosquito are bats, ants, spiders, scorpions, wall-haunting lizards, the wind, and the sun. The only active enemies of stored eggs are book-lice. Ants, though untiring in their search for the smallest particles of food, are strangely indifferent to these eggs.

The favorite breeding places for the larvae are especially apt to be small household containers of water, such as flower pots, tin cans, water buckets, eaves troughs, cisterns, rain barrels, puddles, pools, etc. At least once a week such necessary containers as fire buckets, pans under ice chests, and saucers under flower pots, should be emptied and cleaned. Those that cannot be cleaned ought to be screened or oiled.

Mosquitoes seem to require a blood meal before ovipositing. They tend to develop and lay their eggs in masses, at about three-day intervals, feeding on the first and second days after depositing their eggs and fasting the third. Before the first egg laying they are both diurnal and nocturnal in their feeding habits, biting at any time, subsequently, they are strictly nocturnal in this respect.

Since the yellow fever mosquitoes are not able to convey the disease germs until they obtain them from persons having yellow fever, their mere presence cannot cause an epidemic. Also a person infected with yellow fever is not infectious in the absence of the *Stegomyia* mosquito, and unless the *Stegomyia* mosquito bites the yellow fever patient within the first three days of his sickness, it does not obtain the germs, as they do not occur in the patient's blood after that time. In case they do bite a yellow fever patient within the first three days, and obtain the germs from him, the mosquito

cannot transmit them to another person for from ten to fifteen days more, as it takes that length of time for the germ to develop in the body of the mosquito; but thereafter, it may transmit the disease for several months. A person bitten by the mosquito, who has not had yellow fever, sickens after an interval of three to five days; but one who has once had the disease is immune, and bites thereafter do him no harm.

It requires continuously warm weather for the yellow fever mosquito to breed in sufficient numbers to spread yellow fever. Therefore, this disease never became endemic in the United States. Frost kills, or renders inactive, all mosquitoes. The malaria parasite will not develop in the mosquito at low temperatures.

The diseases now known to be mosquito-borne are malaria, yellow fever, dengue, also called break-bone fever, and filariasis, which is a worm infection, due to mosquitoes.

Measures taken against them, in the Tropics especially, include: the elimination of breeding places, by filling and drainage; introducing sea water into fresh pools; the destruction of larvae by oiling; poisoning with larvacide; the introduction of small fish of the species which feed on larvae; destruction of adult mosquitoes by catching tubes, traps, and fumigation; screening; keeping the non-immune people away from the native villages; and rendering people immune by the use of quinine.

In a purely empirical manner, years ago, a drug was discovered which, when absorbed into the blood, is deadly to the malarial parasite. A Peruvian Catholic priest found that the Indians in certain parts of Peru cured themselves of fevers native to that country by the use of a bark of a certain forest tree common to that region. Its benefits were so evident, that the wife of the Captain General of Peru spread knowledge of its virtue and introduced it into the mother country and other parts of Europe. She was the Marchioness of Cinchona. Quinine remains one of the few specifics known to the medical profession.